MANITOBA POTASH

THE MANITOBA POTASH PROJECT

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Potash, the natural resource that occurs in west central Manitoba, could ensure a secure economic future for the area, and boost the economy of the entire province.

That resource is potash — an essential nutrient for plants.

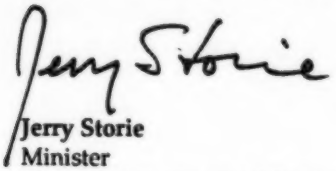
With a rich ore grade, the Manitoba Potash Project can help feed a growing world population. A new mine in Manitoba, timed to accommodate potash demand during the 1990s, will enable Manitoba potash to help maintain Canada's role as the world's leading potash exporter.

Although world demand for potash, and its price in world markets, go up and down in cycles as they do for agricultural products, the long-term outlook for demand is up.

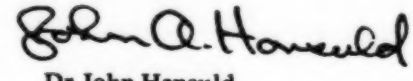
The Government of Manitoba and Canamax Resources Inc. have carried out a number of studies, including a recently-completed, detailed feasibility study, to determine the benefits and costs of developing a potash mine.

The studies confirm that the Manitoba Potash Project — from both a technical and an economic standpoint — is a good investment for Manitoba. The work carried out to date has successfully positioned the project to be the world's next new potash development.

Costs to operate the Manitoba mine will be among the lowest in the world — ensuring Manitoba's competitive position in world markets.



Jerry Storie
Minister
Manitoba Energy and Mines



Dr. John Hansuld
President and Chief Executive Officer
Canamax Resources Inc.

Manitoba
Energy and Mines

Canamax
Resources Inc.

HELPING TO FEED A GROWING WORLD

Uses of Potash

Potash is a term that describes naturally-occurring potassium salts and products derived from them. More than 95 per cent of world potash production is used as fertilizer.

The word "potash" is derived from the old method of producing potassium carbonate by leaching wood ashes and evaporating the solutions collected in large iron pots. The white residue left in the pot was called "pot ash."

Potassium is one of three essential primary plant nutrients. The other two nutrients are nitrogen and phosphorous. Potash helps plants synthesize starch and sugars; it is essential for good flower colour and ripeness in fruits; it stiffens straw in cereals; and it enables plants to withstand adverse conditions of soil, climate, and disease. Even in soils with sufficient potassium, the application of potash ensures the maximum effectiveness of other fertilizers.

Types of Potash

More than 90 per cent of potash fertilizers are sold as potassium chloride (KCl), also referred to as muriate. Potassium chloride occurs naturally as the mineral sylvite in the Manitoba Potash Project deposit.

Sylvite is the highest grade form of potash ore, and the easiest to process. This has an important bearing on the cost of mining and processing the ore and the quality of the finished fertilizer products.

Grades and Rating

Potash fertilizer products must meet minimum purity and size specifications. The potassium content of potash minerals and products is measured in terms of potassium oxide (K_2O). Manitoba's average mining ore grade of 24.5 per cent K_2O makes it one of the richest deposits in the world.

Potash Fertilizer Products

There are several potash products, including Granular, Blender, Coarse, Standard, Special Standard, and White Soluble.

Granular is the coarsest size product, generally used for direct application or for blending with other nutrients. Blender and coarse products are a slightly finer size than granular and are used primarily for blending. Standard product is usually used to make homogeneous fertilizers. Special Standard is a finer-sized, lower-value product. White Soluble is a higher-grade crystallization product with very low water-insoluble content, used to make clear solution fertilizers.

The Manitoba Potash Project will produce Granular, Coarse, Standard, and White Soluble potash.

Where Potash is Produced

Six countries account for about 90 per cent of world potash production: the Union of Soviet Socialist Republics, Canada, the United States of America, France, the Federal Republic of Germany, and the German Democratic Republic.

While Canada's reserves are the world's largest, the Soviet Union currently produces roughly 35 per cent of the world's potash, followed by Canada at about 25 per cent.

Most Canadian reserves are in Saskatchewan, although substantial deposits occur in New Brunswick and Manitoba. Canadian potash ore grade is relatively high, with typical values between 21 per cent and 26 per cent K_2O. By comparison, the average grade of ore mined in New Mexico and Europe is about 15 per cent K_2O. The ore grade ranges from 14 per cent to 21 per cent K_2O in the Soviet Union.

World Markets and Trends

Throughout the 1980s, demand for potash has grown. Still, during the mid-1980s, more potash was available than consumers required. As a result, prices were low, and some mines unprofitable.

Demand for potash will continue to increase in the 1990s. At the same time, old reserves will be depleted. *The Technical and Economic Feasibility Study,* completed in 1987 by Kilborn Engineering and Matrix Enterprises Limited, projects that new mines will be needed in the 1990s to meet world requirements. The Manitoba Potash Project will be able to help meet that need.

The expected growth in world potash markets is linked to the growth in world population. Potash is a key ingredient in fertilizer. Because of a growing world population, demand for potash will increase steadily to help grow the food needed to feed the world.

Between 1980 and 1995, world population will grow by almost 1.4 billion people — reaching a total of 5.8 billion by 1995. The largest part of this increase — approximately 1.2 billion people — will occur in developing countries.

In order to feed this new population, 75 million more hectares of agricultural land will be needed by 1994. In addition, the land now in use must be made more productive. So, there is considerable scope for potash market growth in developing countries such as Brazil, India, China, and other southeast Asian countries.

WORLD POTASH CONSUMPTION FORECAST

Thousands of Tonnes K_2O

	1986	1990	1996
Western Europe	5094	5177	5283
Eastern Europe	9872	11115	13345
North America	4892	5320	5625
Central America	408	463	560
South America	1542	1560	1805
Africa	498	567	675
Asia	3067	3757	4596
Oceania	251	244	274
Agricultural Consumption Subtotal*	25624	28203	32163
Industrial Consumption	745	825	945
Losses	1388	1528	1743
Total Deliveries	27757	30556	34851

*This represents an average annual rate increase in agricultural consumption of 2.3 per cent from 1986 to 1996.

Location of the Manitoba Potash Project

The Economic Potential

The Manitoba Potash Project means benefits for Manitobans. Construction will create about 1,700 person-years of direct employment. The project labour force will peak at about 700 people. It is estimated that Manitobans will make up more than 2/3 of the construction work force.

Indirect employment is created through contracts for equipment and materials, and when workers spend their wages. Altogether, some 2,400 to 3,950 person-years of employment will accrue to Manitobans during the construction phase, including direct and indirect jobs.

Once the mine is in full operation, it will employ 360 workers on a permanent, full-time basis. Up to 230 indirect jobs will also be created.

Location

Located near the Manitoba-Saskatchewan border, the Manitoba Potash Project is 350 kilometres west of Winnipeg, near Russell and Binscarth. It lies just across the border from three Saskatchewan potash mines — PCS Rocanville, and IMC K1 and K2.

POTASH IN MANITOBA

A Rich Deposit

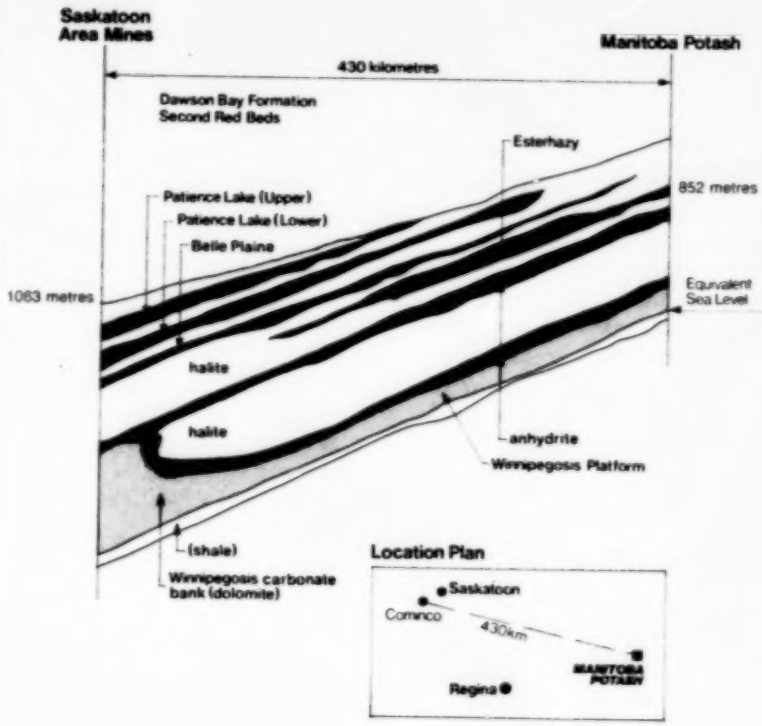
Geology and Reserves

Manitoba's potash reserves lie in the same formation as Saskatchewan's deposits, the Prairie Evaporite formation. This formation, composed mostly of salt, was deposited some 400 million years ago.

Above this formation are layers of unconsolidated glacial sands, silts, boulders, shales, siltstone, sandstone, and carbonates. Immediately below the Prairie Evaporite are layers of more carbonates and shale.

Detailed technical studies have confirmed the results of preliminary studies of the Manitoba potash deposit. Above the deposit, the layers are structurally stable — making for a safe and efficient mine. The deposit itself is very rich, coarse-grained sylvite — with reserves for more than 25 years of mining. The reserves show a good potential for expansion. The ore has an average mining grade of 24.5 per cent K_2O. This compares favourably with the average grade of potash ore from New Mexico and Europe — 15 per cent — or the Soviet Union — 14 to 21 per cent.

The potash bed, 800 to 900 metres below the surface, is about 100 metres shallower than Saskatchewan's beds, making the potash easier and more economical to recover.



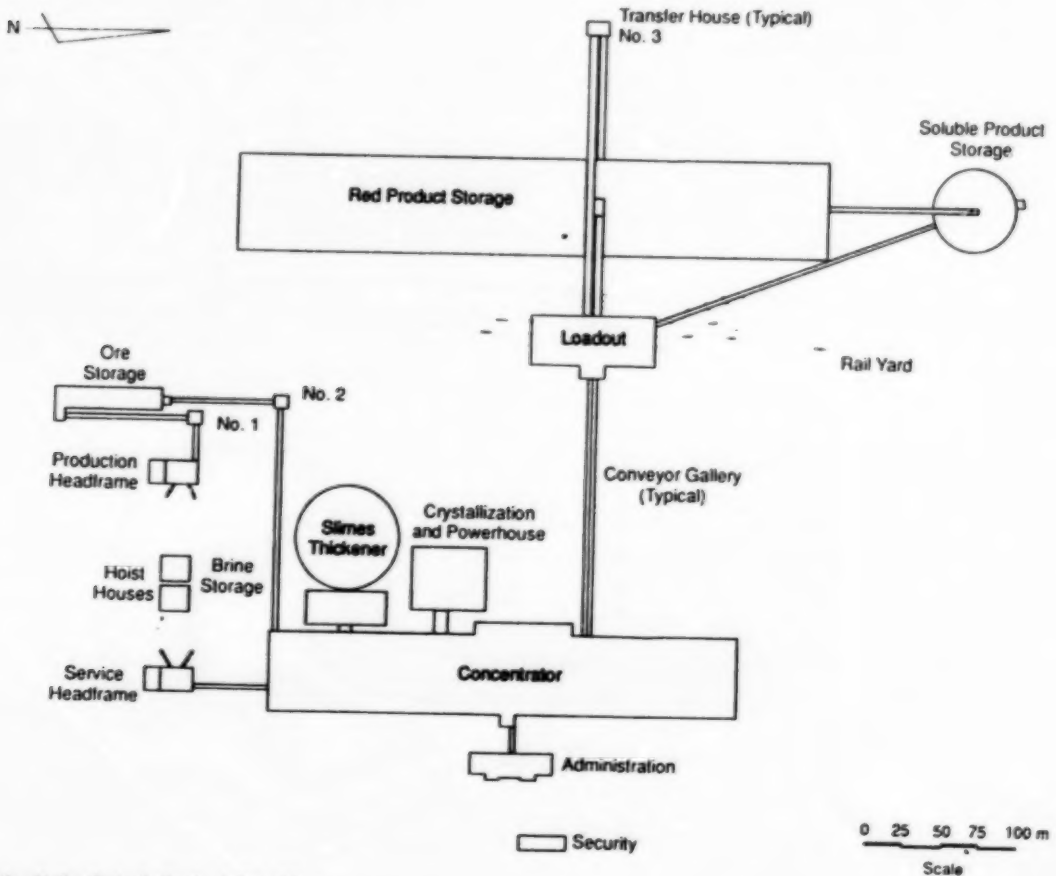
Cross Section: Potash in the Prairie Evaporite

Mining, Hoists, and Shafts

The mine will produce 5 920 000 tonnes of ore per year. It will be equipped with five mining units. Each unit will consist of a four-rotor continuous machine for excavating, two extensible conveyors, and a cross conveyor for material handling.

In a typical potash mine, the working areas or mine faces, after several years of operation, may be up to five or six kilometres from the shaft. The miners travel to the mine face in diesel-powered personnel carriers. The ore is mined by a continuous borer mining machine. These machines have four counter-rotating heads which bore their way through the ore at a rate of eight to twelve tonnes of ore per minute. There are differences in the dimensions of the paths mining machines will cut, but typically, a four-rotor machine will cut a path approximately two and a half metres high and eight metres wide. When the mining machine has made the first pass, it will be turned around to make a second cut, possibly even a third. The ore cut by the mining machine is fed onto a conveyor belt. A series of conveyor belts carry the ore to storage silos and loading pockets at the mine shaft. It is then hoisted to the surface in skips.

Room and pillar mining, as the term implies, involves cutting a series of rooms which are separated by pillars. This technique is restricted to use in areas where the roof, or back, as it is known technically, is sufficiently stable to sustain the weight of the formation above it.



The Manitoba Potash Project Site Plan

A series of rooms is a panel. At the Manitoba Potash Project, panels will be about 1 525 metres by 1 325 metres. Rooms will be 21 metres wide; pillars between rooms will be 32 metres wide.

By using a combination of "retreat mining" and surface and underground exploration techniques, each panel will be developed so that it can be evaluated before it is mined. This will provide the best possible ore grade and recovery in the safest manner.

The Manitoba Potash Project will use two shafts — a production shaft, 5.5 metres in diameter and 894 metres deep, and a service shaft, 5.0 metres in diameter and 876 metres deep. The service shaft will provide fresh ventilation air, while the production shaft will exhaust air from the mine workings. A separate ramp will be driven at an angle to the bottom of the production shaft for access and clean up.

Experience in Saskatchewan has shown that great care must go into designing and sinking a shaft into the Prairie Evaporite formation. The first step is to drill a pilot hole down the centreline of the shaft. A pilot hole has already been drilled for the production shaft as part of the feasibility work. The shaft must be watertight. The Manitoba Potash Project's shafts will use a solid steel liner. Although more costly at first, this will reduce the risk of expensive delays later on. A watertight lining means improved shaft conditions and less corrosion of shaft hoisting equipment.

Shafts will be sunk, using proven technology, in such a way as to stabilize the rock around the shafts. The construction plan calls for ground freezing to a depth of 795 metres, and the creation of a thick ice wall in the water-bearing rock layers.

Processing and Surface Facilities

The milling process removes the impurities, such as salt and clay, and refines the ore into the finished product. The Manitoba Potash Project will use proven, efficient processing techniques, consisting of the following major steps:

■ **Crushing and Grinding**: The raw ore is crushed and introduced into a brine solution and then ground into particles about 1/8 of an inch (3 mm) in size. The purpose of this step is to break the ore into sizes that will release the individual KCl crystals from the individual NaCl (sodium chloride, or salt) crystals.

■ **Desliming**: Following the initial step, the ore is deslimed to remove the minute particles of clay. The clay-laden brine is separated from the solid particles and the clay allowed to settle. The clay is then mixed with salt tailings and waste brine and discarded. The recovered brine is recycled to the beginning of the process.

■ **Flotation**: The potash and salt particles are then prepared for flotation. Four reagents are added: guar, a suppressant, which coats or blinds any remaining clay so it won't use up the expensive amine; amine, an ammoniated beef tallow, which coats the KCl particles but not the sodium chloride (salt) particles; flotation oil, which assists the amine; and MIBC, a frothing agent, which makes the air bubbles in the flotation cell tougher so they can be skimmed from the surface of the cell before they break.

Flotation is the most important step in the milling process; it is during this stage that the KCl is separated from the salt. Air is introduced at the bottom of the flotation tank, causing air bubbles to rise. As the bubbles rise, the amine-coated KCl particles adhere to them and also rise to the surface, where they are skimmed off. The NaCl is drawn off the bottom of the cell, the brine recovered, and mixed with the clay from the desliming step for disposal as waste.

■ **Brine Recovery or Centrifuging**: The centrifuging operation is comparable to the spin cycle in a washing machine. In separate centrifuges, the brine is spun out of the potash and recycled to the beginning of the whole process.

■ **Drying**: From the centrifuge, the potash particles pass through large fluid bed driers. Once dried, the potash is moved to the screening area for sizing into the principal products. The drying step, however, separates a certain amount of fine potash which was floated along with the coarser particles. This dust has economic value and is recovered by a side process called crystallization.

■ **Crystallization**: Dust from the drying and product screening stages is dissolved in hot brine. The hot brine is cooled under vacuum in the crystallizers which causes the potash to precipitate out in white, highly pure crystals of potassium chloride. The end result is a crystallized product known as White Soluble KCl.

■ **Sizing**: Sizing is the step in which the potash particles are put through a series of screens of different mesh size. This operation yields the products Granular, Coarse, and Standard.

From the mill, the Granular, Coarse, Standard, and White Soluble products will be conveyed separately to on-site product storage, truck, and railcar loading facilities.

Surface facilities have already been designed for the Manitoba Potash Project. They will include some 17 low-cost steel structures covering about 194 hectares of land.

Utilities

Mining and processing will use hydro-electricity. Natural gas will be used for product drying and mine air and building heating. A standby propane storage and handling system will be provided.

Two hundred and four cubic metres per hour of fresh water will be obtained from the Assiniboine River, about three kilometres east of the plant site. This represents less than one per cent of the minimum flow through that part of the river. The water will be stored and re-distributed on-site. An on-site water treatment plant will treat potable and steam generator makeup water.

Tailings and Brine Disposal

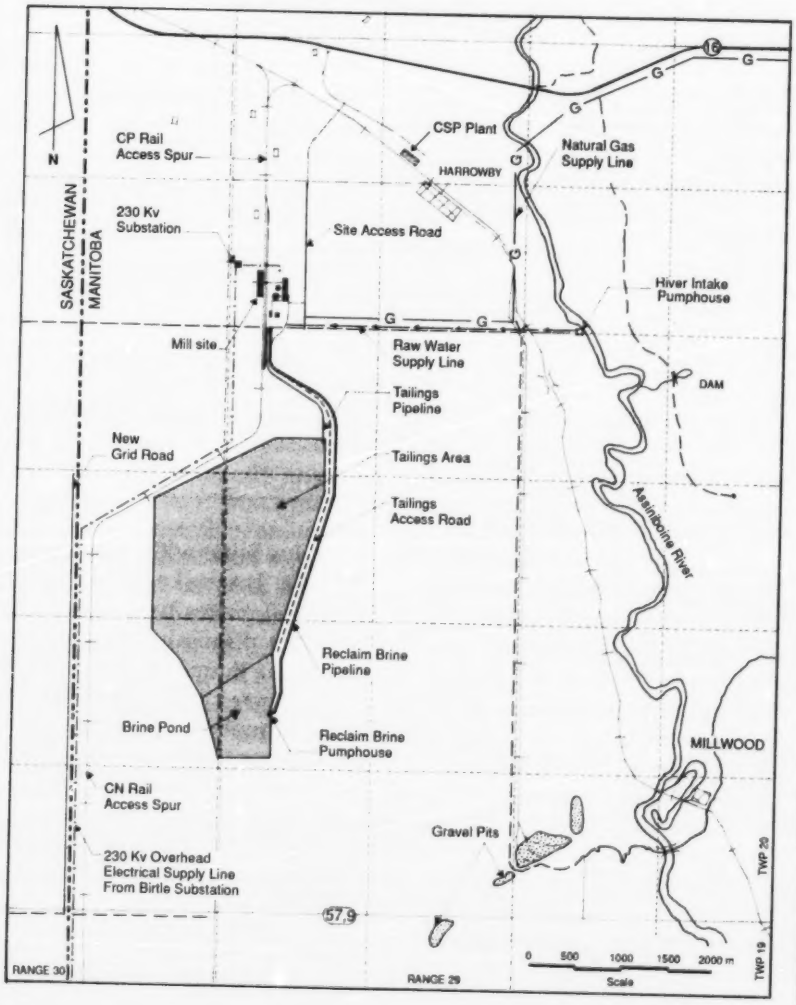
The milling process will produce about 4 000 000 tonnes of waste tailings per year. Tailings are the waste residue separated from the potash product when the ore is processed. The disposal technique, similar to that used in Saskatchewan, is safe, proven, and simple to operate and maintain.

MANITOBA POTASH PROJECT SUMMARY DATA

Ore			
Mineable ore reserve	164,700,000 tonnes		
Grade	24.5 % K2O (as sylvite)		
Mine production and mill feed	5 920 000 tonnes/year		
Products			
Mill production	2 000 000 tonnes of KCl/year		
Mill recovery	86.0 %		
Product grade	60.0 % K2O minimum		
Product mix (typical)	Granular	1 000 000	tonnes/year
	Coarse	200 000	tonnes/year
	Standard	600 000	tonnes/year
	White Soluble	200 000	tonnes/year

At the Manitoba Potash Project, the waste management area will be contained by earth dykes. It will consist of a tailings pile and reclaim brine pond. Surface water and groundwater seepage wells will be built to monitor possible brine seepage.

Surplus brine will be pumped into the Interlake formation, about 950 metres below the surface. Two disposal wells will be located at the plant site, about 1 000 metres apart. This technique is similar to the petroleum industry's use of injection wells to dispose of salt water.



The Manitoba Potash Project Site Map

Siting

The Manitoba Potash Project will be located about two kilometres east of the Manitoba /Saskatchewan border and three kilometres south of Yellowhead Highway Number 16.

The plant will cover about three quarter-sections (194 hectares) of land, stretching over about 800 metres by 1 300 metres. The tailings pile and brine pond area, about two kilometres south of the mine site, will be approximately 430 hectares.

The site is well-situated for road and rail access. Ground conditions in the immediate area are favourable for building foundations, tailings containment, roads, and rail construction.

Construction Plan and Operation

Construction of the shafts, underground, and surface facilities can be completed within 5 years from a decision to proceed with the project.

Mine construction will provide many opportunities for Manitoba labour, fabricators, and contractors. The number of workers employed on-site will rise from approximately 120 in Year 1 and peak at nearly 700 in Year 4.

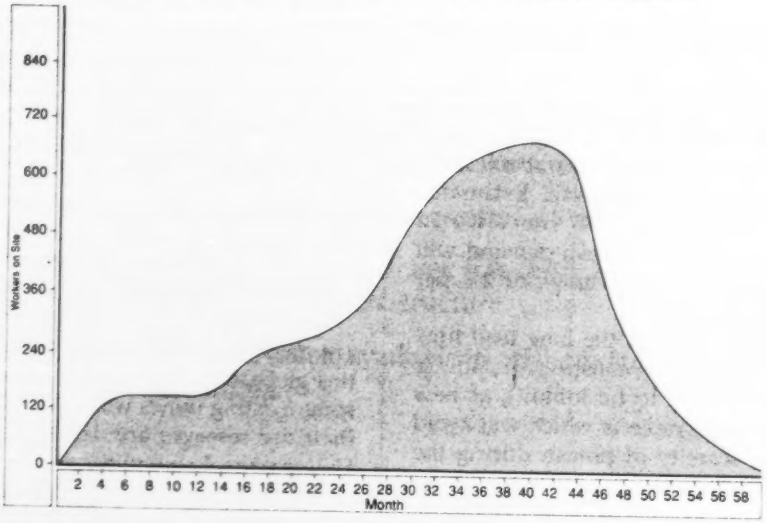
The construction workforce will be housed in a fully-serviced construction camp, to be built next to the construction site. The camp will sleep 700, and will include a kitchen and dining room facility and a recreation unit.

During construction, the following types of workers will be needed on site:

- Boilermakers
- Bricklayers
- Carpenters
- Electricians
- Insulators
- Labourers
- Millwrights
- Miners
- Operating Engineers
- Painters
- Pipefitters
- Reinforced Iron Workers
- Roofers
- Sheetmetal Workers
- Structural Iron Workers

The mine will be operated by 360 employees, including 33 administration, 170 mine, and 157 mill personnel.

MANITOBA POTASH PROJECT EMPLOYMENT CURVE



Marketing and Transportation

World Supply and Demand

World demand for potash, although cyclical — prone to ups and downs — has been increasing. The long-term outlook is for continuing growth. Estimates through to 1996 show world agricultural potash demand will grow by an average of 2.3 per cent per year.

Because of the long lead time required for construction, now is the time to be looking at new potash projects which will avoid a scarcity of potash during the 1990s.

Unlike many other commodities, potash has no substitute as a fertilizer. In the past, the developed economies of western Europe and North America have consumed most of the world's potash. Over the next decade, much of the new growth in world demand is expected to occur in Asia and Latin America. China and India, in particular, are increasing their fertilizer use in order to feed their growing populations.

A major portion of Canadian potash sales are to United States customers. U.S. demand for potash has increased rapidly over the last 20 years, mainly in response to changes in the types of crops being farmed. Recently, demand has slackened because of the downturn in agriculture. However, the U.S. reserves are substantially depleted, and the U.S. will remain an important market for Canada's potash.

Very few new potash projects are currently planned to meet this global demand growth, and some existing mines will close as their ore reserves are depleted. Unless several new mines or major expansions are announced soon, a shortage of potash is expected to emerge by the mid-1990s.

The Manitoba Potash Project can play a major role in helping developing countries feed their growing populations. Manitoba and Canamax are seeking investors in one or more of these potash-consuming countries to become partners in the Manitoba Potash Project. In return, we can promise them a secure supply of the potash they will need.

Potash Prices

In general, potash prices have risen with inflation since the early 1960s. Despite this overall upward trend, the 1970s and 1980s have seen a pattern of ups and downs in potash prices. Since early 1987, prices have improved significantly. This trend is expected to continue.

Transportation

A competitive haulage system for Manitoba potash has been designed. Transportation costs have been worked out based on available, long-term lease arrangements. Both Canadian railroads have offered competitive rail rates for Manitoba potash to the United States, Vancouver, Thunder Bay, and eastern Canada. Trucking is a cost-effective alternative for short hauls.

Costs and Economics

Capital and Operating Costs

Kilborn Engineering estimates that the Manitoba Potash Project will incur a total fixed capital cost (in 1st quarter 1987 Canadian dollars) of $540 million.

The capital cost estimate includes the following: site preparation, shaft sinking, mine development, underground equipment and facilities, headframes, all on-site surface storage and processing facilities, tailings storage area and brine disposal, camp construction, engineering, procurement and construction management, owner's costs, and contingency.

Kilborn Engineering has estimated that annual operating costs will total $52.5 million, or $26.26 per tonne of product, at 200 000 tonnes per year, expressed in 1987 Canadian dollars. Due to the richness of the deposit, its favourable mining and milling characteristics, and the scale of the project, these operating costs are among the lowest in the world.

This estimate includes site labour, materials, energy, property taxes, miscellaneous expenses, and a contingency allowance.

Economic Evaluation

The economic evaluation undertaken by Kilborn Engineering suggests that the Manitoba Potash Project will be attractive to investors, with an after-tax return well above the hurdle rate that is typical for projects of this kind.

ADVANTAGES

- Opportunity to meet the demands of a rapidly-growing world market
- High quality deposit equivalent in ore grade and mining conditions to the most efficient Saskatchewan mines
- Among lowest direct operating costs in the world
- Strategically located close to key transportation lines, utilities, and townsite infrastructure
- Efficient transportation available to offshore and United States destinations

PROJECT MILESTONES

- Preliminary engineering and economic evaluation completed 1985
- Shaft pilot hole completed 1986
- Full feasibility study completed 1987
- Decision to build the mine
- Initial production four years after decision to build the mine
- Full production five years after decision to build the mine

FOR FURTHER INFORMATION

If you want to know more, please contact the Manitoba Potash Project through the Manitoba Energy and Mines Info Centre or Canamax Resources Inc.

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